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Document Name: SAE J557: High Tension Ignition Cable

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HIGH TENSION IGNITION CABLE—SAE J557

SAE Standard

Report of Electrical Equipment Division approved July 1921 and last revised by Electrical Equipment Committee June 1961. Reaffirmed without change January 1968.

Scope—The specifications contained in this report cover high tension cable used in motor vehicles or tractor engine ignition systems.

1. Specification Types

Type HTLR—High Tension, Low Resistance Conductor, Rubber Insulation, Synthetic Sheath.

Type HTHR—High Tension, High Resistance Conductor, Rubber Insulation, Synthetic Sheath.

Type HTS—High Tension, Metallic Conductor, Rubber Insulation, Synthetic Sheath.

Type HTB—High Tension, Metallic Conductor, Rubber Insulation, Braided Covering.

Type HTT—High Tension, Metallic Conductor, Thermoplastic Insulation.

2. General Specifications

Conductors—Type HTLR and Type HTHR—The conductor shall consist of a resistor element capable of producing a specified designed resistance in the finished cable.

Type HTS, Type HTB and Type HTT—The metallic conductor shall consist of 7 or 19 strands of wire having a lay twisted to the left as viewed from the observer. The diameter of the stranded group shall not exceed 0.060 in. or be less than 0.030 in. The individual wires shall be treated so that there will be no interaction between the wire and insulating compound.

Insulation—A homogeneous insulating compound shall be applied directly over the conductor. The insulating compound on Types HTS, HTB and HTT shall adhere closely to, but shall strip readily from the wires of the conductor, leaving them reasonably clean. The thickness of the insulating compound shall be such that it will meet the applicable tests for each cable type.

Inner Braid—When specified, an open braid of suitable textile shall be applied over the insulation.

Sheath—When specified, a synthetic material shall be applied concentrically over the insulation or over the inner braid, if used. It shall be so compounded as to meet the tests specified. Adjacent layers of cable, when wound on reel or coil or packed in sets, shall not stick to one another at any temperature under 121 F.

Outer Braid—When specified, a protective braid shall be applied over the insulation compound. The braid shall be so treated as to be resistant to heat, oil, water and gasoline. Adjacent layers of cable, when wound on a reel or when packed in sets, shall not stick to one another at any temperature under 105 F.

Size—The outside diameter of the cable shall be within 0.270 to 0.285 in. Cable may be slightly flattened or oval in section, but the average of two diameters measured 90 deg apart at any section must be within the values specified.

Marking—When specified, the manufacturer's name and/or manufacturer's identification, the quarter, year, and cable type shall be legibly and reasonably permanently marked on the outside of the cable at intervals not exceeding 2 ft.

3. Cable Construction

Type HTLR—High Tension, Low Resistance Conductor, Rubber Insulation, Synthetic Sheath.

Construction

(a) Conductor—See Section 2, Conductors.
(b) Insulation—See Section 2, Insulations.
(c) Inner Braid—(when specified) See Section 2, Inner Braid.
(d) Sheath—See Section 2, Sheath.
(e) Size—See section 2, Marking.
(f) Marking—See Section 2, Marking.

Tests—The cable shall meet the following tests:

Life Cycle —See Test No. 1
High Temperature—See Test No. 2
Low Temperature —See Test No. 3
Hot Oil Test —See Test No. 4
Resistance —See Test No. 9

Type HTHR—High Tension, High Resistance Conductor, Rubber Insulation, Synthetic Sheath.

Construction

(a) Conductor—See Section 2, Conductors.
(b) Insulation—See Section 2, Insulation.
(c) Inner Braid—(when specified) See Section 2, Inner Braid.
(d) Sheath—See Section 2, Sheath.
(e) Size—See Section 2, Size.
(f) Marking—See Section 2, Marking.

Tests—The cable shall meet the following tests:

Life Cycle —See Test No. 1
High Temperature—See Test No. 2
Low Temperature —See Test No. 3
Hot Oil Test —See Test No. 4
Resistance —See Test No. 9

Type HTS—High Tension, Metallic Conductor, Rubber Insulation, Synthetic Sheath.

Construction

(a) Conductor—See Section 2, Conductors.
(b) Insulation—See Section 2, Insulation.
(c) Inner Braid—(when specified) See Section 2, Inner Braid.
(d) Sheath—See Section 2, Sheath.
(e) Size—See Section 2, Size.
(f) Marking—See Section 2, Marking.

Tests—The cable shall meet the following tests:

Life Cycle —See Test No. 1
High Temperature—See Test No. 2
Low Temperature —See Test No. 3
Hot Oil Test —See Test No. 4

Type HTB—High Tension, Metallic Conductor, Rubber Insulation, Braided Covering.

Construction

(a) Conductor—See Section 2, Conductors.
(b) Insulation—See Section 2, Insulation.
(c) Outer Braid—See section 2, Outer Braid.
(d) Sheath—See Section 2, Sheath.
(e) Size—See Section 2, Size.
(f) Marking—See Section 2, Marking.

Tests—The cable shall meet the following tests:

High Potential —See Test No. 5
Corona —See Test No. 6
Low Temperature —See Test No. 7
Life Cycle —See Test No. 8

Type HTT—High Tension, Metallic Conductor, Thermoplastic Insulation.

Construction

(a) Conductor—See Section 2, Conductors.
(b) Insulation—See Section 2, Insulation.
(c) Inner Braid—(when specified) See Section 2, Inner Braid.
(d) Sheath—See Section 2, Sheath.
(e) Size—See Section 2, Size.
(f) Marking—See Section 2, Marking.

Tests—The cable shall meet the following tests:

Life Cycle —See Test No. 1
High Temperature—See Test No. 2
Low Temperature —See Test No. 3

4. Tests—All electrical tests shall be made with 60 cycle alternating current. The voltage specified shall be mean effective values (root-mean square). Voltage shall be increased from zero to the prescribed test value at a uniform rate of rise approximately but not exceeding 3 kv per sec or as otherwise specified.

1. **Life Cycle Test**—One end of a suitable length of cable shall be secured to a ½-in. diameter mandrel. A weight of 10 lb shall be attached to the free end. The mandrel and cable specimen shall then be rotated. Five complete turns shall be wound around the mandrel, coils touching. The cable shall then be unwound and rewound in the opposite direction. The complete winding cycle shall be performed twice.

The specimen shall then be wound on a 1-in. dia mandrel so that there are five turns spaced ¾ in. apart. At the time of winding on the 1-in. mandrel, one end of the cable shall be firmly attached to the mandrel and a 5-lb weight shall be attached to the outside of the other end of the specimen. The mandrel and specimen shall then be placed in a snug fitting, belled metal shield. The specimen with mandrel and shield shall be subjected to the following tests:

(a) Heat 5 hr at 250 ±3 F. Remove from the oven and immerse in water maintained at 120 ±3 F for a period of 18 hr. Remove and drain for 30 min. Subject specimen to 15,000 v applied between conductor and sheath for 30 min. Follow by:

(b) Immerse in SAE 30 oil and maintain at 194 ±5 F for 18 hr. Remove and drain 30 min. Subject specimen to 15,000 v applied between conductor and sheath for 30 min. Follow by:

(c) Immerse in kerosene for a period of 18 hr at room temperature. Drain for 4 hr. After completion of tests, the insulation shall not crack, rupture, show excessive swelling or other evidence of damage.

2. **High Temperature Test**—Suitable lengths of cable shall be suspended straight in a ventilated oven maintained at a temperature of 250 ±3 F for 48 hr. The specimen shall then be removed from the oven, allowed to cool to room temperature, then wrapped 360 deg. around a ½-in. mandrel. Cracking of the outer jacket shall constitute failure.

3. **Low Temperature Test**—Suitable lengths of straight specimens shall be placed in a cold chamber maintained at –30 F for 24 hr. Without removing from the cold chamber, wrap specimen 360 deg around a 3-in. diameter mandrel which has also been subjected to the same time and temperature as the specimen. Cracking of the outer jacket shall constitute failure.

4. **Hot Oil Test**—Twenty-inch specimens shall be immersed in SAE 30 oil maintained at a temperature of 250 ±5 F for a 40-hr period. The ends of the specimens shall protrude 3 in. above the oil and be 1 in. apart. The oil shall be circulated during the test. Remove from oil and allow to cool to room temperature, wipe free of oil and wrap center portion 360 deg around a ½-in. dia mandrel against curvature of bend. Excessive swelling, cracking or rupture of jacket shall constitute failure.

5. **High Potential Test**—One inch of insulation shall be removed from each end of an 18-in. length of the cable and the exposed ends of the conductor twisted together. The loop so formed shall be immersed in water at 68 F (20 C) ±5 F so that 4 in. of each leg of the loop protrudes above the surface of the solution. After 24-hr immersion and while still immersed, a potential of 20,000 v shall be applied between the conductor of the cable and the water and shall be maintained for 20 min. The cable shall withstand this test without failure.

6. **Corona Test**—A 5-ft length of cable, having a 5-lb weight attached to the free end, shall be wound 10 turns on a metal rod 1 in. in diameter, with adjacent turns touching. The cable shall then be secured to prevent slipping or release of tension. A potential of 10,000 v shall be applied between the conductor of the cable and the metal rod and maintained for 30 min. The potential shall then be raised to 20,000 v and maintained for 2 hr.

This test shall be started with cable and metal rod at a temperature of 68 F (20 C) ±5 F. The cable shall withstand this test without failure.

7. **Low Temperature Test**—A sample of the cable 5 ft in length, shall be stretched straight on a rack and subjected to a temperature of

−10 F (−23.3 C) ±5 F for 12 hr. The cable shall then be wrapped around a 3-in. mandrel, with cable and mandrel at a temperature of −10 F. Cracking of the outer covering of the cable shall constitute failure.

8. Life Cycle Test—One end of a 5-ft specimen shall be firmly attached to suitable cylindrical mandrel with a diameter of ½ in.; a weight of 5 lb shall be firmly attached to the end of the specimen. The specimen shall be wound in a clockwise direction on the mandrel with the coils touching. It shall then be unwound and rewound in a counter-clockwise direction so that the coils again touch. This procedure shall be repeated until no less than two bends in each direction have been imposed on the specimen. The specimen shall then be removed from the ½-in. and wound on a 1-in. mandrel so that there are five turns spaced ¾ in. apart. At the time of winding on the 1-in. mandrel, one end of the cable shall be firmly attached to the mandrel and the 5-lb weight attached to the outside of the other end of the specimen. After winding, a close fitting brass sleeve with belled ends shall be placed over the wound mandrel. The test specimen shall then be subjected to the procedure and conditions specified in Table 1 and shall not be removed from the 1-in. dia mandrel until they have been completed.

TABLE 1—OPERATIONS TO BE PERFORMED AND CONDITIONS TO BE MAINTAINED

Time Consumed, hr	First 24-Hr Period	Second 24-Hr Period	Third 24-Hr Period	3-1/2-Hr Period
3	Rest	Rest	Drain	Drain
1/2	Corona Test 15 kv	Corona Test 15 kv	Corona Test 15 kv	Corona Test 15 kv
1/2	Rest	Rest	Rest	—
20	Bake in oven at 176 ±20 F.	Soak in 5% sodium chloride solution at room temperature, ends protruding not more than 8 in. nor less than 4 in.	Soak in solution of 1 part kerosene,[a] 1 part motor fuel, 2 parts engine SAE 30 oil, ends protruding not more than 8 in. nor less than 4 in.	—

[a] Kerosene conforming with Federal Specification VV-K-211.

9. Resistance Test—The resistance of Type HTLR and Type HTHR shall be within the limits shown in Table 2 when measured with a standard commercial multi-purpose meter with a low voltage power source by using ½ in. probes on each lead and a 13 in. piece of cable. Probes must be carefully inserted ½ in. into the conductor. The cable should then be tested as follows:

(a) Measure resistance of cable after 50 lb tension.

(b) Measure resistance of cable after being wound and unwound five turns on a ½-in. dia mandrel. Wind cable under 5 lb tension.

TABLE 2—RESISTANCE OF TYPES HTLR AND HTHR CABLES

Cable	Resistance - Ohms per Ft	
	Low Limit	High Limit
Type HTLR	3000	7000
Type HTHR	6000	12000